

TASK #: 07-040 Non Volatile Memories

QUARTERLY TECHNICAL PROGRESS REVIEW

TASK # & TITLE:	Nonvolatile Memories
QUARTER:	4Q FY07
COORDINATING CENTER:	GSFC
PARTICIPATING CENTER/S:	
PROGRAM AREA:	NEPP
TASK MANAGER:	Dr. Timothy Oldham/GSFC
FY07 FUNDING:	
CUSTOMER:	

TASK DESCRIPTION

Assessment of Nonvolatile Memory

- **NVMs are widely used throughout the aerospace community for program, configuration, and data storage.**
- **Existing mainstream commercial technology (floating gate flash) is very sensitive to radiation**
- **New NVM approaches (nanocrystal, magneto-resistive, ferroelectric, phase change (chalcogenide) and others) are approaching commercial viability, but radiation response of new materials has not been determined**
- **Perform radiation evaluations of new nonvolatile technologies as they become available**

GOALS/OBJECTIVES

Assessment of Nonvolatile Memory

Nonvolatile memories are critical to NASA programs, but mainstream commercial technology is sensitive to radiation damage. New technologies, approaching commercial maturity, may be much more resistant to radiation

DELIVERABLES

Assessment of Nonvolatile Memory

FY07 Deliverables	Quarter Due	Quarter Completed	Notes (changes to deliverable list or why not on schedule)
Samsung 4G Flash TID Tests	2	Report 3	
Samsung 4G Flash HI Tests	2	Test 3 Report 4	Latchup test carried over to Q3 because of failure of heating element
Micron and Hynix 4G TID Tests	3	Test report 3	
Micron and Hynix 4G HI Tests	4	Test report 4	
Monitor CNT, CRAM, MRAM and FeRAM progress	1-4		
Other flash (AMD 1G MirrorBit NOR)	TBD		

SCHEDULE

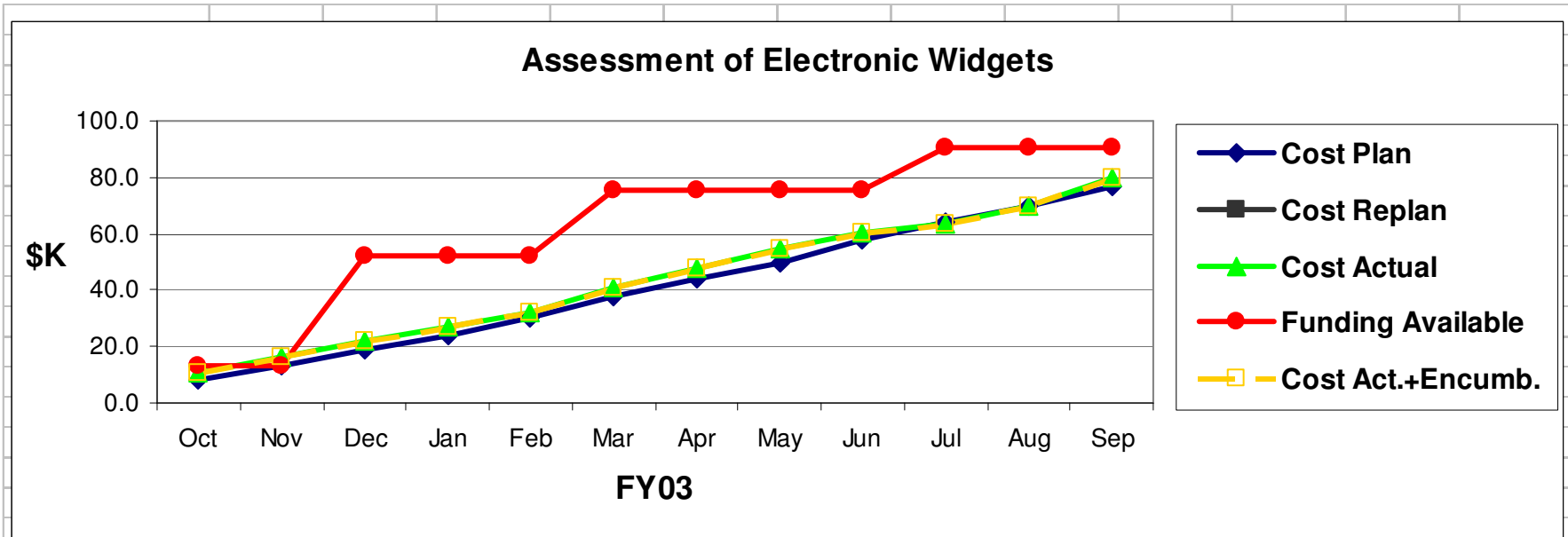
Assessment of Nonvolatile Memory

NVM	2006			2007								
Radiation T&E	O	N	D	J	F	M	A	M	J	J	A	S
Monitor MRAM, CRAM, CNT, and FeRAM progress												
Samsung Flash TID Test				◆								
Micron, Hynix Flash TID Test								◆				
Samsung 4G HI Test				◆				◆				
Micron/Hynix Flash HI Tests								◆			◆	
ST 1G Flash HI Test				◆								
Test Reports				◆		◆			◆			◆

This is what we'd like to see, but I don't expect each technical manager to do this.
A summary at branch or section level is sufficient.. Please make sure your branch/section manager knows.

BUDGET/WORKFORCE

Assessment of Electronic Widgets



Assessment of Electronic Widgets 100774-1.2.ABC.0	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Cost Plan	8.0	13.0	19.0	24.0	30.0	38.0	44.0	50.0	58.0	64.0	70.0	77.0
Cost Replan												
Cost Actual	11.0	16.1	22.0	27.0	32.2	40.9	48.0	54.7	60.5	63.8	69.6	79.9
Cost Variance	3.0	3.1	3.0	3.0	2.2	2.9	4.0	4.7	2.5	-0.2	-0.4	2.9
Funding Available	12.9	12.9	51.9	51.9	51.9	75.3	75.3	75.3	75.3	90.7	90.7	90.7
Encumbrances	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cost Act.+Encumb.	11.0	16.1	22.0	27.0	32.2	40.9	48.0	54.7	60.5	63.8	69.6	79.9
WF Plan	0.50	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.40	0.30	0.30	0.30
WF Actual	0.39	0.34	0.34	0.36	0.33	0.33	0.33	0.31	0.24	0.23	0.31	0.32

MAJOR ACCOMPLISHMENTS THIS QUARTER

Assessment of Nonvolatile Memory

- **Completed heavy ion testing of Micron and Hynix 4G flash at TAMU**
- **Completed flash recommendation for SWRI**
- **Zero bias and low dose rate flash tests planned**
- **Samsung 8G single die flash promised for next quarter**

TECHNICAL HIGHLIGHTS

Assessment of Nonvolatile Memory

- TID test of Samsung 4G 63 nm flash indicates parts function to at least 100 Krad, which is sufficient for most NASA missions.
- Samsung 4G 63 nm flash was tested with heavy ions, and in follow-up high temperature tests for latchup, both at TAMU.
- Micron and Hynix 4G flash was also tested for TID and HI response at TAMU.
- None of the parts latched up, but the SEFI rate was lowest for the Samsung. Calculated error rate (CREME96, geosynchronous orbit at solar minimum) was 1×10^{-12} errors/bit-day

PLANS FOR NEXT QUARTER

Assessment of Nonvolatile Memory

- Zero bias and low dose rate testing planned for Samsung, Micron and Hynix 4G flash
- TID testing of Freescale 4M MRAM is planned

Partnering

Assessment of Nonvolatile Memory

- DTRA ??? co-funding
- Samsung has agreed to provide 8G parts
- Test procedures, facilities, and other infrastructure are also used for volatile memory and other testing efforts.

PROBLEMS AND CONCERNS

Assessment of Nonvolatile Memory

- None